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ScienceDirect

Transportation Research Procedia 46 (2020) 285–292

Transportation Research Procedia

www.elsevier.com/locate/procedia

City Logistics 2019

Public procurement as a strategic instrument to meet sustainable policy goals: the experience of Rotterdam

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Abstract

The Dutch government, in alignment with the Paris climate agreement, has expressed the ambition to reduce CO_2 emissions in the Netherlands by 49% in 2030 compared to 1990. As freight transport is recognized as a serious CO_2 emitter, this sector is confronted with a substantial part of the target. For cities, the reduction of the urban freight transport emissions is, next to the CO_2 reduction, also important to improve the air quality. Dutch municipalities take an active role in coordination, facilitation and acceleration of the emission reduction processes, not only via regulation but also by using their public procurement power. This paper describes the City of Rotterdam's experiences from the EU Horizon 2020 BuyZET project. This project was launched in November 2016 and includes the cities of Rotterdam, Oslo and Copenhagen. The project aims at understanding and optimising the impact of public procurement activities on transport patterns and emissions in cities as well as to find innovative and sustainable delivery solutions for goods and services-related transport in order to reduce emissions.

Keywords: public procurement, zero emission transport, city logistics, carbon footprint mapping.

1. Introduction

Dutch municipalities take an active role in coordination, facilitation and acceleration of emission reduction processes. The developed emission reduction approaches also need to make sure that the proposed measures ensure an efficient, uncongested and seamless mobility system, and all, within the limited budget conditions. There are several options for the city to support and speed up the urban freight transport's emission reduction: regulation, financial

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10.1016/j.trpro.2020.03.192

incentives, support the development of sustainable transport innovations, invest in the infrastructure, etc. At the same time, public administrations procure a huge range and volume of products and services each year that directly and indirectly require transportation. Every product purchased must be delivered, whether paper clips or streetlights and most services purchased by public administration involve the movement of goods and personnel, whether cleaning services, road maintenance, or waste collection. There is a growing recognition that public authorities themselves are attractors of large transport flows and as such public procurement can be used as a strategic instrument for helping to reach specific policy goals.

This paper describes the experiences of the City of Rotterdam in the EU-funded BuyZET (acronym for Buy Zero Emission Transport) project. In Rotterdam, the air quality policy has always been an important driver for traffic measures. The city is actively involved in improving the efficiency and sustainability of city logistics: e.g. the introduction of the zero emission vehicles is supported by a range of privileges, currently the new charging infrastructure vision is being developed, there is growing attention to the "logistics performance" of construction sites, the development of the roadmap towards the medium-sized zero emission zone in the inner city is in progress. In terms of the purchasing policy, the recent Corporate Social Responsibility covenant is the umbrella for the long-standing efforts in the area of sustainable procurement. The Rotterdam Sustainability Programme sets the ambition to become a clean, green and healthy city. The action plan encourages sustainable procurement practices to support the transition to a more resource-efficient city and to develop concrete paths towards sustainable public procurement. This paper first explains the emission mapping methodology developed. Next, each step of the mapping methodology is described using examples. Finally, the results of the emission mapping for Rotterdam are presented. The conclusions highlight both the major difficulties within the process, as well as opportunities any city can have going through the process.

2. Mapping municipality emission profile: methodology

There are several options for municipalities to act on relating to public procurement in order to reduce urban emissions; e.g. include green public procurement criteria in tendering processes, consolidate procurement flows within several organisations/internal departments, replace their own fleet with zero emission vehicles, establish new business models or contractual agreements, support decarbonization of specific procurement categories, look into new forms of joint or coordinated procurement with other purchasing bodies, or change internal buying behaviour. Which method or combination of methods to choose depends on the established city's objectives as well as on the procurement category it is targeting. The next procurement category/contract to "decarbonize" can be identified on the basis of the following criteria:

- meaningfulness (the amount of CO_2 emissions that can be reduced by decarbonizing this procurement category is substantial),
- feasibility (it is possible to decarbonize this procurement category),
- visibility (it is possible to make the effects of decarbonization visible externally and internally within the organization),
- expected snowball effect (the number of clients reached by decarbonization measures next to the municipality itself), and
- the fit to the planning (the contracts that shortly require renewal).

The mapping methodology developed in BuyZET allows cities to identify the transport carbon footprint and local emissions from all the procurement activities involving transport. It provides both an overall picture on where the city stands in relation to CO_2 emissions from its own transport fleet and transport services that are (directly or indirectly) procured, as well as more insights in the most CO_2 intensive procurement clusters. The results provide an indication of meaningfulness of the CO_2 reduction, an understanding of how feasible it is and what potential snowball effect it may have.

The BuyZET mapping methodology is based on data that is directly available at municipalities: e.g. purchase contract data, receipts data and fuel management system data. Using a set of specific steps and assumptions it allows the money spend from the procurement system to be translates to kilograms/CO_2 emitted. In order to improve the quality of results, information from the procurement system should be as much as possible complemented/verified by other sources available for the municipality, such as: on-site vehicle counts, interviews and surveys with suppliers,

interviews with contract managers, and open source data. As stated in BuyZET (2017a) "with the primary objective of getting as accurate results as possible, the mapping methodology needs to be flexible enough to deal with different data available for different services provided by/for and on behalf of the municipality".

For these reasons, a two-phase approach for emission mapping has been developed. The main objective of Phase I is to get an overall picture of what the most transport emission-intensive procurement clusters are. In this phase, accuracy is important to the extent that can be achieved with the data available, as collecting data directly from suppliers (in this phase) is time consuming and cost intensive. Therefore, "data should be sufficiently accurate to enable intended users to make decisions with reasonable assurance that the reported information is credible. At the same time, from the industry perspective absolute accuracy is less important than ensuring the aspects of comparability (for decision making) and ease of use, whilst respecting an acceptable level of accuracy" (GLEC, 2016). In Phase II a deeper investigation on the emission intensive procurement clusters from Phase I is performed, resulting in a more accurate and precise emission footprint for that category. Phase II includes more comprehensive data collection in order to understand all the specifics within the procurement cluster that emits the most. Phase II looks deeper into indicators such as the frequency of trips, used transport modes and other parameters that will help to assess the impact of zero emission decisions on the disruptiveness of trips, congestion and other important city characteristics.

The BuyZET methodology is founded on the following footprint calculation methods: fuel-based (the total volume of fuel consumed by a fleet over a year), distance-based (the total distance travelled by vehicles in different categories) and spend-based (the total amount spent on, or average price of fuels). The footprint estimation performed with the fuel-based method is the most accurate. When fuel data is not available, it is possible to do estimations of fuel consumed based on the assumptions on the distance travelled per category of vehicles deployed or based on the amount of money spent on fuels. If there is no data available to estimate the fuel consumed, it is possible to apply distance and spend-based methods. The spend-based method is effective for screening purposes, however it has the highest levels of uncertainty compared to other two methods. Therefore, in the mapping approach we go from plan A (fuel-based) to plan C (spend-based), balancing between the data available and accuracy of the results. The remainder of this paper focusses on the Phase I results for Rotterdam.

2.1. Step 1: Definition of the mapping exercise scope

First, it is necessary to define the geographical, institutional and operational scope of the mapping exercise. Public authorities can include a high variety of organisations (ranging from executive agencies to schools, hospitals, museums, etc.) and are responsible for a wide spectrum of services (e.g. waste collection, street maintenance, provision of social and public transport). By defining the scope, a selection of an appropriate inventory boundary and selection of activities that should be accounted for within the emission calculation is performed. For this, a number of factors can be considered (WRI et LMI, 2013): organizational structures (determining which activities an organization owns, controls or operates), operational boundaries (identifying on-site and offsite activities, shared facilities, processes, and services), operational context (understanding the nature of activities, geographic locations, sector(s), purposes of information, and users of information).

2.2. Step 2: Identification of the transport categories

The BuyZET mapping approach divides all activities performed and procured by municipalities into three transport service categories. Table 1 provides further insights in the characteristics of each category. These three transport categories are:

- Category 1: The services performed by municipality with its own fleet.
- Category 2: Procurement of services for which the transportation of people or goods is the central component of the contract, but which are performed for municipality by a third-party provider using the third party provider's transport fleet;
- Category 3: Procurement of goods, works and services where transportation is not a central subject of the contract but is necessary in order to realize the contract (using the third-party provider's transport fleet).

The definition of what services/contracts fall under which category is very important as it has a direct impact on the accuracy of the information necessary to estimate the footprint, on the degree of the influence a city has on the

provision of the service and on the transport footprint of this contract. Therefore, the CO_2 mapping approach may vary per transport category.

Table 1. BuyZET transport categories

	Category 1	Category 2	Category 3
Type of procurement	Goods, works and services	Services	Goods, works and services
Fleet ownership	Own or leased fleet	Third party providers	Third party providers
Number of suppliers	Non relevant	Limited	High
Municipality influence on the fleet	High	Medium	Low
First hand data availability	High	Medium	Low

2.3. Step 3: Sorting out of the procurement invoices

Sorting out of the procurement invoices in groups helps to further fine tune transport categories identified in step 2 and limits the invoices database to those invoices that have generated transport movements. It also helps to correct potential errors committed during manual entry of the invoices in the existing categories within the procurement system. The cities in BuyZET had a look at all procurement invoices for the period of one year. Once these invoices were extracted into the database, they were than manually categorised into the following groups: transport (e.g. garbage collection, taxi), service (e.g. training, repair, cleaning), products (e.g. paper, IT equipment, clothes), energy (e.g. electricity, heat, water), and immaterial (e.g. rent, software, consulting). The groups energy and immaterial do not generate transport movements, therefore invoices that fall into these groups can be further excluded from the mapping exercise. According to the definition of the transport categories developed in BuyZET, invoices for transport categories 1 and 2, where transport is a core of the procurement contract, will fall into the Transport group and Service and Product groups will include invoices from category 3. The procurement system differs a lot per municipality. Therefore, the level of sorting out invoices can differ per municipality too: some can use contracts as the most appropriate sorting out level, whereas others need suppliers or invoices.

2.4. Mapping transport category 1

BuyZET transport category 1 includes the vehicle fleet in ownership or leased by the municipality. Municipalities are then accountable for the activities they perform and usually own the fleet management system or another system (e.g. fuel receipts) that provides a clear overview of the types and the number of vehicles, and information on the total amount of fuel consumed per vehicle.

CO_2e emissions from transportation (sum across fuel types): (e1)

$$\sum\left(quantity\ of\ fuel\ consumed\ (litres) * emission\ factor\ for\ the\ fuel\ (e.g. kgCO2e/litres)\right)$$

+ sum across grid regions:

$$\sum\left(quantity\ of\ electricity\ consumed\ (kWh) * emission\ factor\ for\ the\ electricity\ grid\ (e.g. kgCO2e/\ kWh)\right)$$

+ sum across refrigerated and air-conditioned types:

$$\sum\left(quantity\ of\ refrigeration\ leaking * global\ warming\ potential\ for\ the\ refrigeration\ (e.g. kgCO2e/\ kWh\ )\right)$$

Municipalities should aim to apply the fuel-based method for calculating emissions for category 1, using the formula described in equation 1 (WRI et LRI, 2013).

2.5. Mapping transport category 2

The BuyZET transport category 2 encompasses all transport activities that are “hired” by municipality to perform public services. This will differ per municipality and might, for example, include public transport services, waste collection services or any other public services in cases where they arenot performed by their own fleet. It is necessary to consider whether the city cooperates with other cities on provision of the services, in order to properly calculate the share of emissions attributed to a specific municipality. For category 2, the degree of influence the municipality has

on the transport service is more limited (than for category 1) and the municipality has restricted access to information/data as these services are not operated by their own fleet. The number of service providers in category 2 is usually limited and municipalities may have long-term relations with them. With the growing number of companies estimating and reporting on their emissions as part of their social responsibility efforts, the first step in data collection is to ask the service providers to provide an estimate of carbon footprint from the transport activity under their control. If the carbon footprint is not obtainable from the service provider, the next option is to request from service provider information on the fuel consumed per vehicle type used for this service. If the relationship with providers does not permit such requests, or the number of providers is too large to perform requests, it is necessary to consider going to the next two possible footprint calculation methods: distance or spend based methods.

2.6. Mapping approach for transport category 3

For the BuyZET transport category 3 it is the most difficult to obtain an accurate image of the carbon footprint. This category encompasses the delivery of goods that serve as a support to the main activity of the municipality. Category 3 is characterized by a large variety of third-party providers from which it is necessary to collect data, as data availability is very limited and is most probably insufficient to provide a reliable estimation of transport emissions. The information that needs to be extracted from municipalities procurement systems in order to perform emission mapping, should contain the unit price and total invoice volume per invoice. Mapping is then performed for each procurement group (PG), identified in Step 3 (i.e. sorting out of the procurement invoices), separately and can be programmed to be performed automatically. The footprint mapping for the procured goods suggests the following steps:

- We identify, based on the unit price extracted per invoice from the procurement system the average unit price for the goods in one PG (from step 3).
- We assume the average weight of goods within this PG.
- We compute the value of goods per PG, by dividing the average price of goods on the average weight of goods.
- We compute the total quantity of goods delivered within this PG, by dividing the total invoice amount (or per invoice, if automated), on the value of goods in the PG.
- For this PG we assume what type of vehicle delivered the goods and identify/assume CO_2 emission factors, average loading factor and loading capacity of that vehicle.
- We assume the amount of the kilometres performed by the supplier in order to deliver these goods to the municipality, considering also return trips and kilometres allocated to the municipality within the total vehicle trip.
- We compute the total distance run by the vehicle, by dividing total quantity of goods delivered by the used vehicle capacity multiplied by the kilometres performed by supplier.
- We compute the total emissions, by multiplying the total distance run by the vehicle on the corresponding vehicle emission factor.

In a similar way the footprint mapping of the services procured by the municipality is assessed, using the total procured value from the procurement system invoices and with assumptions performed on the hourly wage per type of service, work pattern for this specific type of service, amount of kilometres driven by personnel for the location and modes of transport used for this.

3. From invoices to priority clusters in Rotterdam: results

The geographical scope of the mapping exercise for the City of Rotterdam was defined by its city boundaries (Figure 1).

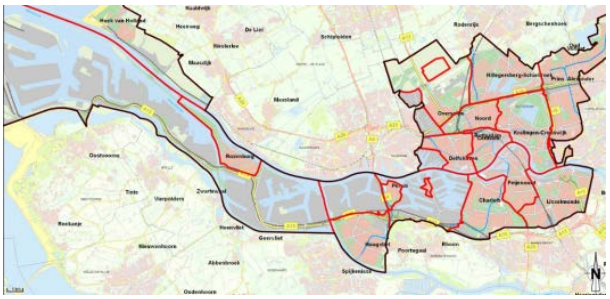

Fig. 1. Rotterdam mapping scope

The municipality has around 11,000 employees and is divided into 7 organisational clusters. Procurement and purchasing has been to a very large extent centralised: each division issues requests for purchase and/or procurement to the Procurement and Purchasing division. The estimated total value of the public procurement budget in 2016 in Rotterdam was approximately 1 billion euros. Performing the mapping exercise, the city of Rotterdam explicitly has chosen to focus on the CO_2 and air quality emissions associated with delivery transport within the city boundaries, therefore limiting the distance travelled by the suppliers by the ring road. Table 2 describes BuyZET transport categories for Rotterdam.

Table 2. BuyZET transport categories for Rotterdam

	Category 1	**Category 2**	**Category 3**
Rotterdam example, 2016	Vehicle fleet of 677 diesel vehicles, functioning within, for example, urban development, urban maintenance, social employment organisational clusters	Public transport: 275 buses, 112 trams, 159 metro carriages; Social transport: approximately 250 drivers using 158 vehicles per day, 20,000 km covered each day in 2000 trips	Goods: general suppliers, paper, ICT equipment, etc; Services: catering, security, after-sale support, maintenance, etc.

In 2016 Rotterdam's procurement system contained 420 pre-defined categories, 1,130 contracts, 6,693 suppliers and 133,595 invoices. During methodological step 3, it was decided to sort out invoices on the level of suppliers. This categorisation in Rotterdam has resulted in 11 transport groups (invoices from transport categories 1 and 2), 30 service groups and 59 product groups (invoices from transport category 3), and 5 energy groups and an immaterial invoice group, which were excluded from the further analysis. Generally, the "90 – 10% rule" can be applied to all these levels, meaning that the focus can be on the biggest contracts/invoices: 10% of the suppliers usually provide 90% of the goods or services delivery volume.

For the mapping of emissions from the transport category 1 in Rotterdam, the fuel administration system was used as a primary information source. The emission mapping was performed only for diesel-fueled vehicles. The city has guidelines for the replacement of gasoline fueled vehicles by electric vehicles by 2020, therefore those were excluded from the analysis. Usage of the fuel-based method for 677 diesel vehicles (428 vans and 249 trucks) resulted in the computation of 6,633 tonnes CO_2; 48,190 kg NO_x; 1,163 kg PM and 39.9 kg SO_2 emissions from Rotterdam's own fleet.

As indicated in Table 2, transport category 2 for Rotterdam includes public transport and social transport. The public transport services for Rotterdam are procured at regional level by the Metropoolregio Rotterdam – Den Haag (MRDH), which grants concessions for a 7-year period. The current provider of public transport services in Rotterdam is RET, with the concession that runs until 2019. Rotterdam has decided to prolong the concession period by another 7 years if RET proves before the contract expiration date that it will make the transition to emission free services by 2025, in line with the national ambition. In 2016 the RET fleet was composed of 275 buses covering 61 regular lines and 14 nightlines, 112 trams covering 12 lines and 159 metro carriages covering 5 lines. The city has recently finalised the procurement procedure for social transport for the contract period 2018-2025. There are 158 vehicles used by the current social transport provider, running in total 6,678,720 km in 2016. Using the data received from these suppliers, the total CO_2 emissions for transport category 2 in Rotterdam was estimated to 19,420 tonnes CO_2; 112,984 kg NO_x; 3,833 kg PM; 114.6 kg SO_2.

For the mapping of the transport category 3 emissions, steps indicated in section 2.6 were applied to 30 procurement service groups and 59 procurement goods groups of the city of Rotterdam. This resulted in the estimation of the overall emissions from category 3 as: 2,632 tonnes of CO_2, 8,321 kg of NO_x; 676 kg of PM; 18.6 kg of SO_2. Next to this, the results of the footprint mapping for category 3 also permitted Rotterdam to identify the most emission intensive procurement clusters. For the group of goods, sand appeared to generate the highest amount of kms driven. These types of goods are usually transported by heavy vehicles, therefore, resulting in the highest CO_2 emission footprint (figure 2). Looking at the logistics footprint of services, the travel of construction workers emits the most, considering the type of vehicles they are usually using in order to perform their activity (Figure 3).

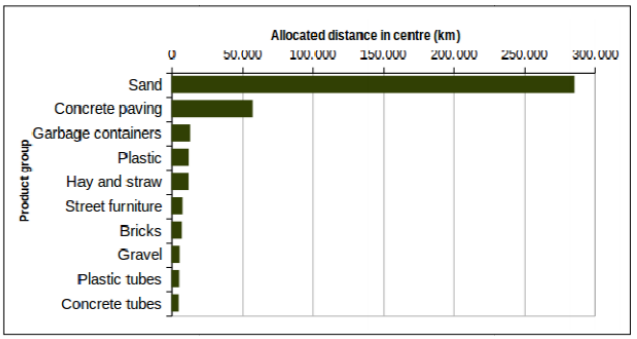

Figure 2: Distance driven within city boundaries for the most important product groups.

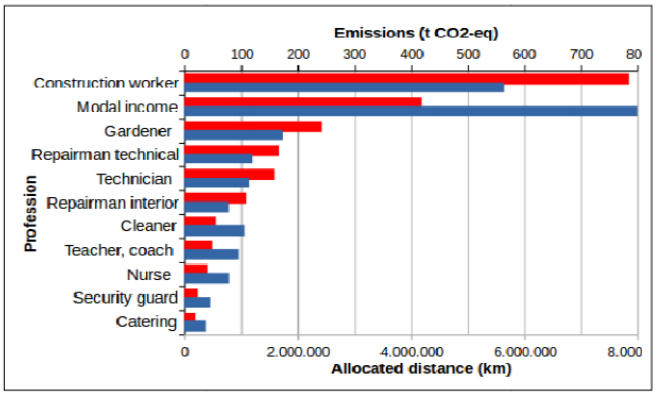

Figure 3: Distance driven within city boundaries (blue) and CO_2 emissions (red)

The mapping exercise has illustrated that in 2016 the total emissions from the City of Rotterdam procured transport activities (categories 1, 2 and 3 together) resulted in the 28,685 tonnes CO_2; 169,494kg NO_x; 5,672kg PM; 173.1 kg SO_2 emitted within the city boundaries. Public transport is responsible for more than half of the local emissions for all investigated local pollutants. A total of 68% of CO_2 generated by Rotterdam's transport following from procurement contracts, was done within transport category 2, 23% within category 1 and 9% within category 3.

The city of Rotterdam has already a plan for the systematic replacement of vehicles in the city's own fleet (transport category 1). For passenger cars and light vans, the directive is already in force stating that vehicles are no longer being replaced unless by ZE (zero emission) alternatives. For heavier duty vehicles, 2030 is foreseen as a realistic deadline for completing the elimination of fossil fuel from this segment. With respect to public transport and social transport (transport category 2) ZE policy aims have been defined and are being realised as part of the current concession and contract, respectively, to meet the 2025 deadline. Within category 3, mapping and prioritization have identified that at this moment the most emission-intensive clusters for the city of Rotterdam are: construction materials (in particular, sand) and heavy goods, office supplies (primarily paper), clothing and items for personal protection, and technical maintenance services.

This information allowed Rotterdam to focus decarbonisation efforts on these large procurement areas. As a follow up, for construction materials and technical maintenance service procurement goods, open market dialogues with

suppliers were held. Each of these dialogues resulted in the list of obstacles, possible measures and potential strategies, on how to facilitate the delivery of goods and services within this procurement cluster in a sustainable and zero emission way. The last phase of the BuyZET project involves the translation of these outcomes into a procurement policy for the prioritized goods and services. Part of this has already been done and is currently being reported. In the case of sand delivery, the obstacles identified have resulted in a small-scale pilot project to try out ZE sand transport in practice.

In the case of transport services for moving furniture and equipment between working locations and election stations, guaranteed 100% ZE transport at the end of the 6-year contract period was defined as a requirement, with an additional award if this requirement is met earlier or quicker. Two election events in the first half of 2019 have proved to be a useful test case. In the case of maintenance services for working locations, the contract period was shorter and there was a preference to divide the work in many small lots. Requiring the use of ZE transport was considered disproportional, so a milder variant was chosen. It involves 2 appraisals of the suppliers' business fleet of freight vehicles with the ECO-stars recognition scheme. The first time at the beginning of the contract, and a second time after a 3 year period. The supplier can only be granted an extension of the contract if the second appraisal shows enough progress towards ZE vehicles.

4. Conclusion

Making an impact starts with getting a clear picture of where the municipality stands in relation to its procurement behaviour and resulting carbon footprint and what the most emission intensive categories are of the goods and services procured. By acting on their own procurement, municipalities can reach to a large and diverse range of transport flows circulating in the cities. Municipalities yield large purchasing power, which can be enough to incentivise market players to come up with green transport solutions. This purchasing power can help to get a critical mass necessary for the upscaling of efficient sustainable transport innovations. In the framework of the limited budgets, a "sustainable" approach to public procurement helps make sure that decisions taken are both environmentally friendly and financially efficient.

Experiences of BuyZET cities have illustrated that CO_2 footprint mapping, especially when conducted for the first time, is not an easy exercise: procurement contracts do not contain transport related information which is necessary to compute the CO_2 footprint. In order to make estimates, internal procurement data from invoices should be identified, extrapolated and translated into the CO_2 footprint with the help of additionally collected data and assumptions. All together it costs time to have basic data collected, algorithms automated and running. At the same time performing mapping and looking at the procurement beyond its administrative functions allows cities to identify emission-intensive procurement categories and effectively direct its actions on decarbonizing it, demonstrating an environmental leadership, paving the way to other urban freight transport stakeholders. Through this process, the city gets first-hand knowledge on what works and what does not in calculating and, more importantly, reducing CO_2 and air pollutant emissions from specific transport flows. This helps to create better policies targeted on urban stakeholders working on the reduction of GHG and air pollutant emissions. Finally, it helps to increase awareness of the footprint resulting from their own procurement behaviour and tailor their procurement policy in order to get optimal benefit from their spending.

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